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Agro-Environmental Approaches to the Moderation of Outmigration from Northeast Thailand

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Figure 1. Regional map of Thailand with provincial boundaries and neighboring countries. Geographic map by Steven A. Martin, 2017, Thailand Photo Journal.

Chapter I

An Overview of the Outmigration from the Northeast

Thailand's increasing migration rates out of the country's poorest region over the past few decades have resulted in a range of issues for both migrants and relatives of the migrants who choose to remain. Migrants from the Northeast, also termed Isaan, moving into Thailand's urban center are facing issues related to social and economic deprivation. A combination of rapid urban growth in Bangkok and dwindling economic opportunity in Isaan are driving rural-to-urban migration. The Isaanese have been subject to Bangkokian's attributions of ruralness and otherness. These perceptions towards rural migrants resulted in the economic, social, and political exclusion and structural inequalities that persist.

The Northeast boasts some of the lowest employment, public spending, education, and economic productivity rates in the country. As of 2005, Isaan has the highest unemployment rates in the country, most significantly for people under 30. One of the most common complaints from Isaanese is the lack of decent-paying jobs which also contributes to the low living standards in the region. In comparison to the other regions that comprise the country, the North, Central, and South, the Northeast had the lowest level and share of wage and salaries. With the lowest labor productivity in the country, there was almost no growth in this metric from 1991-2004.

While region has the largest proportion of households involved in farming at 70 percent, they also have smaller average plots than the Northern and Central regions,

indicating higher incidences of subsistence farming. Despite have more farm labor than the rest of the country, the Northeast consistently has the lowest agricultural productivity. The next least productive region, the North, out produces Isaan by an estimate of 60 to 80 percent.

The absence of decent-paying jobs and increasing labor demand in Bangkok drives rural-to-urban labor migration out of the Northeast. With some of the highest level and shares of private transfers, except for Bangkok, labor migration and remittances create a dependency of Isaan on the rest of Thailand. The share of households receiving remittances seems to be increasing across Thailand with the highest increases and shares being in Isaan. Over half of the Isaanese households receive remittances and account for an average of one third of total household income.

Many rural dwellers have begun to flock to Bangkok to escape the threat of climate change and maintain livelihoods. Meanwhile, climate change is set to drastically transform the landscape of the earth and geographic concentration of people, particularly, in Thailand. The Department of Meteorology in Thailand reported that from 1981 to 2007, the average temperature rose by 1℃. They also expected the average temperature to further rise by 1.2-1.9℃ within the next 30 years, further destabilizing global climate. A century's worth of climate change has already begun to exacerbate environmental disasters in the country. Faced with droughts, floods, sea-level rise, and changes in precipitation patterns, time is running out to implement mitigation measures.

The current Northeast to urban migration, driven by extreme weather, is set to deepen this division. In global history, mobility has been a typical response of the rural poor to escape dispossession, exclusion, and marginalization. Without appropriate action,

the rural-to-urban movement will continue to result in an existing division between people of rural origin and those born in the metropolitan area. Furthermore, Bangkok is reaching its limits of population density. Rapid industrialization and economic growth combined with increasing population and unorganized urban development has degraded much of the urban landscape as the city cannot maintain infrastructure at the rate it is demanded (Boonprasirt n.d.).

This thesis will discuss various agro-environmental and general policy solutions to the issues associated with the rural-to-urban migration from Isaan to Bangkok. To attract migration back to Isaan, the implementation of Climate Smart Agriculture in the near term and eventually, Regenerative Agriculture, will likely build climate resilience in the face of climate change and raise farm income and productivity. These changes include a recommendation to transition to supplementary agriculture to avoid unsustainable groundwater extraction rates and provide farm resilience in the face of increasing rainfall variability. Changes in crop variety to those that could withstand larger periods of droughts and flooding may stabilize farm incomes. GMOs, implemented with agricultural extension agents, may also supply Isaanese farmers with consistent yields and promote local food security.

In addition, the development of infrastructure in growing Northeastern secondary cities should be considered. Increasing accessibility to urban centers in the Northeast may help residents acquire the benefits associated with agglomeration. Finally, Thailand ought to take a passive approach to internal movement. History of conflict, urban exclusion, and government-sponsored resettlement has contributed to conflict in the South and has caused the nation to lose out on economic growth associated with agglomeration.

Chapter II

Migrant Origins and Destinations

Economic Deprivations of the Northeast

In the last few decades, Thailand has made great strides in reducing poverty in the Northeast. Poverty rates fell from 62.5 percent in 1988 to 9.85 percent in 2018 (Yang, Wang, and Dewina 2020). However, in 2016 and 2018, national poverty rates increased, and experts expect poverty reduction rates to continue to slow. Until the last few years, the Northeast constituted the highest poverty rates in Thailand. Currently, the South has both the slowest rates of poverty reduction and the highest poverty rates, Yet, Isaan still has the most people living under the UMIC poverty line, at 2.5 million people (Yang, Wang, and Dewina 2020).

For rural Thailand, the recent decline in poverty reduction reveals household vulnerabilities to economic shocks and inequality. Between 2015 and 2017, real farm incomes in rural households fell, becoming a major source of increased poverty rates. From 2007 to 2013, increases in real wages, farm income, and remittances regions were oppositely sources of poverty reduction (World Bank 2020b).

Almost 70 percent of households in Isaan are involved in agriculture. The North and Northeast have been plagued by floods and droughts that contribute to stunted regional economies. For example, in Q2 2019, agricultural output fell by 1.3 percent due to a drought that began in May of 2019. Food grain production, very important for the Northeast, fell by 18 percent in the same quarter (World Bank 2020b). Food prices

remained stable despite declines in production because farmers bore the burden of the drought in the form of losses of farm incomes, which further contributed to poverty and regional inequality.

As Thailand continues its transition toward a more industrialized country, regional inequality becomes a more obvious trend. From 2000 to 2007, Thailand experienced an average annual GDP growth rate of 5.19 percent. In the eight years following the Great Recession, annual GDP growth dropped to 2.98 percent 33 (Loftus 2017). From 2000 to 2018, Thailand's Gini coefficient fell from .43 to .36 , representing an overall increase in wealth equality (World Bank 2020a). However, a 2016 assessment which calculated per capita income of each of the regions as a ratio to Bangkok, found that the Northeast fell behind every region (UNFPA 2016). Disparities in economic growth rates were glaring in 2017 when Thailand's economy overall grew by 3.5 percent but the incomes of the bottom 40 percent of the wealth distribution experienced declines (Loftus 2017).

The Role of Education in Outmigration

Between 1988 and 2002, access to secondary education increased by almost 20 percent to a total of 70 percent in Isaan, but still falls behind with respect to post-secondary education and vocational school. Respectively, vocational and university attendance in the northeast is about 1 and 7 percent while in the other regions, estimates fall around 5 and 11 percent.

Since the mid-1980s, Thailand has made great strides in expanding access to public education and narrowing inequalities due to socio-economic conditions. With primary school enrollment rates remaining at near universal levels since the turn of the century for all quartiles of per capita income, more children are receiving a basic education

(Sondergaard 2015). In the 1990s, the Thai government implemented a series of education legislation aimed at improving the quality of legislation. These efforts materialized in 2003 with the decentralization of education administration to 175 entities, called education service areas, which provided parents, teachers, students, alumni, and community groups with representation at the local level to voice their concerns and ideas. However, despite decades' worth of progress in quality and equity, Isaan remains behind the rest of Thailand.

Studies show an existing range of factors working against the achievement of stable, quality education in the Northeast (Sondergaard 2015). Secondary school enrollment in the poorest quartile of per capita income rose from just ten percent in 1986 to 70 percent in 2010. The poorest quartile still falls behind the secondary school enrollment rate of the next poorest quartile by ten percent (Sondergaard 2015). Within secondary institutions in Isaan, rural schools are found to operate less efficiently than ones located in urban settings, likely due to socioeconomic deprivations, poor public facilities, and an inability to attract more qualified instructors (Kantabutra and Tang 2006).

The Organization for Economic Co-operation and Development uses the Program for International Student Assessment to measure 15-year-olds' literacy. A 2013 study showed the prevalence of urban-rural disparities among test-takers (Lounkaew 2013). Urban students outperformed their rural counterparts, had access to more educational resources like internet and computers, and had more highly educated parents (Lounkaew 2013).

Studies have found that those who have better health and higher education are more likely to migrate, and those with an education past primary school are less likely to

return (Piotrowski and Tong 2010; World Bank 2020b). Regional differences in secondary school education rates bode poorly for Isaanese migrants moving into urban areas. In competition with higher-educated workers in Bangkok, Isaanese migrants will be less qualified for higher-paying, more dignified jobs, as many do not have a high school education (Reda et al. 2012).

Characterizing Outmigration from Isaan

Rural-urban migration characterizes both long-term and seasonal migration in Thailand. Rural-urban movement has resulted in over 50.5 percent of the population to be concentrated in Bangkok (UNESCAP 2016). Thailand's rural-urban migration is driven by a rapid expansion of the industrial and service sector, centered in the city. According to a survey of migrants from 2,200 rural households in Isaan, 46.8 percent noted "job opportunity" as their primary reason for migration (Reda et al. 2012). In 2009, the industrial sector employed almost three quarters of Thailand's internal migrants, which represented a ten percent increase from 1999 ("Overview of Internal Migration in Thailand" 2018). While yearly migratory statistics often fail to account for seasonal labor migrants, studies have found that migrants from the Northeast move to Bangkok during the dry season and move back to participate in agriculture in the wet season (Guest et al. 1994). The highest rate of returnees to their home regions among rural-urban migrants are those involved in agriculture (Piotrowski and Tong 2010). The internal movement in Isaan is consistent with historical trends of laborers moving towards more productive regions to partake in economic growth.

Expansion of employment opportunities that occurred in Bangkok due to the labor-intensive manufacturing and construction booms left Isaan's agriculture sector

relatively undesirable, especially to young workers (Floch and Molle 2015). Increasing labor demand in urban areas widened the wage gap between the competing sectors and resulted in nearly 15 percent of Thai agricultural workers abandoning their farms in pursuit of better wages (Floch and Molle 2015).

Working Conditions Among Rural Labor Migrants

About 80 percent of rural-urban migrants report improvement in their working conditions from their previous job and two thirds say their living conditions have improved since leaving the rural region (Reda et al. 2012). However, 70 percent of rural-urban migrants working in urban centers lack a written contract, 40 percent lack a stable income, 21 percent have private insurance, and 20 percent still earn less than minimum wage in Bangkok (Reda et al. 2012). Minimal social protections for rural-urban migrants put them in vulnerable positions in terms of exploitation, job insecurity, and abuse.

Female migrants likely experience even bleaker working conditions than male migrants. Consistent with the global pattern, female Thai migrants are paid less, but send remittances back in larger quantities and with more frequency than their male counterparts (IOM 2011). Female migrant-dominated occupations such as domestic, factory, and sex work are less likely to receive the same social protections as other industries (Reda et al. 2012). Only until 2012 were domestic workers provided some social labor protections in Thailand. Still, protections in domestic work do not cover limited working hours, minimum wage, or social security (ILO 2013).

Rural-to-urban migration is especially difficult for young migrants as well. Studies have shown that about 56 percent of rural-to-urban migrants between 16 and 25 years old reported emotional abuse. About half of migrants between the ages of 15 and 20

move into the Bangkok alone to find work. Further, migrants younger than 15 were more likely to experience physical and emotional abuse than older migrants (Jirapramukpitak et al. 2011).

Linguistic Discrimination

About 80 percent of the Isaaneese are of Lao descent (Draper and Sawat Selway 2019). Laotian individuals tend to have darker skin and be shorter than other ethnic groups in Thailand, providing a physical basis for discrimination, particularly in Bangkok. Dialects in Isaan occur on a spectrum with Lao on one end and Thai on the other. In Isaan, people may change where they land on the spectrum daily. Conversations in academia and professional settings lend Isaaneese to speak with more of a central-Thai accent where use of the Lao accent is more often used when addressing another Laos (McCargo and Hongladarom 2004, 27) The distinction between Lao and Thai dialects leads to another means of labelling 'otherness' and discrimination against Isaaneese in Thailand's urban center.

This discrimination is part of a larger trend in which Laotian people or Thai citizens of Lao descent are viewed as inferior. A conversation about what it meant to be 'Isaaneese' with an informant of Lao descent living in Isaan noted that Laos may present themselves to other Laos in two different ways. One way is to present themselves as Lao which puts them on equal grounds, indicating community and commonality while the other way is to present themselves as Thai, intentionally implying Thai superiority over Laos (McCargo and Hongladarom 2004, 28) Another informant whose family came from Isaan but who had grown up in Bangkok reflected on the different uses of the word 'Lao'. They noted

how the use of the word in Bangkok, especially by her classmates growing up in elementary school, used ‘Lao’ as a derogatory term (McCargo and Hongladarom 2004, 28).

Linguistic patterns in Thailand are complex in part due to the abundance of ethnic diversity. The Central Thai language, or *phasa Thai* meaning “Thai language”, is most commonly used (Alexander and McCargo 2014). One study estimated just under 84 percent of the population spoke at least one native language other than the standard Central Thai (Smalley 1994). *Phasa Thai* dominates education, major media outlets, national politics, and is associated with dignity and status (Smalley 1994, 13).

In Northeast Thailand, language is dominated by a “dialect” of Thai called, *phasa isan*, which heavily incorporates linguistic elements of Lao Despite *phasa isan*’s official standing as a dialect, many Isaanese regard it to be an entirely separate language (Alexander and McCargo 2014). A majority of Thai people learn Central Thai in school. However, most rural students only use Central Thai in professional or urban settings by the time they complete their education requirements (Smalley 1994, 14). Thus, the “dialect” represents a pillar of Isaanese identity that is separate from the Central Thai identity advocated for by the Thai government.

The rest of Thailand, the Greater Bangkok Region particularly, regards the Isaanese as socially and economically backwards and unsophisticated. This is in part due to the long history of economic deprivations in Isaan which continues today. Much of the economic growth and physical development in Thailand is concentrated in Bangkok and Central Thailand partially due to a national movement towards a centralization in social, governmental, and economic spheres. Juxtaposed to Isaan’s history of small-scale

farming, growth in all facets in Bangkok lead to an overwhelming sense of inequality (Alexander and McCargo 2014).

These perceptions create a sense of inferiority of the entire region that has endured since Isaan was recognized as a vassal state according to the Kingdom of Siam in the late 1800s (Alexander and McCargo 2014). At this time, Isaan was heavily influenced by neighboring Laos. While the cultural ties have been weakened since then, many Lao migrant workers continue to influence sociocultural practices. Many of the Isaanese rural-urban migrants can be distinctly recognized by their accents and suffer from discrimination in urban settings as a result.

Effects of Outmigration in Isaan

In 2016, the National Statistical Office found about 30 percent of internal migrants were between 14 and 15, while nearly 55 percent were between 25 and 29. Overall, almost 85 percent of internal migrants in Thailand were under 30 years old. Many migrants are parents or young adults, resulting in a dual concern for children of migrant parents and an aging society.

About one quarter of children in Isaan (around three million) whose parents are migrants are left behind ("Overview of Internal Migration in Thailand" 2018). Nearly one in three children in the Northeast live with a relative other than their parent. Some studies have found that parental migration can have a negative impact on child development (Aihara et al. 2006; Institute of Population and Social Research 2012).A 2006 study found that about 60 percent of children with one or both parents who have migrated reported feeling sad, especially if the migrant parent was the mother. Thai children of non-migrants are reported to be more responsible, independent, and happier than their

counterparts (Institute of Population and Social Research 2012). However, some evidence demonstrates that migration of one or more parents may be regarded by the child as beneficial. Following the migration of a parent, about 40 percent of children perceive life to be easier, and over 50 percent think they are in better financial positions With 58 percent of caretakers reporting that remittances have “a lot” of benefit to the child and 30 percent saying they have “some benefit”, a total of 88 percent of caretakers report remittances having a positive impact on the child Children left behind report that they are highly satisfied with life, psychologically well-adjusted, and perform academically similarly to children of non-migrants (Institute of Population and Social Research 2012).

Thailand is a rapidly aging society with likely 14 to 20 percent of population being 65 years old or older by 2024, which would classify it as an aged society (ABD 2017). Rural-urban migration and pursuit of economic industries other than agriculture of young adult has left the elderly behind to tend to family farms in Northeast Thailand (Rigg et al. 2020).The proportion of farmers in Isaan 45 years or older increased from 23 to 52 percent from 1993 to 2013 (Rigg et al. 2020). A growing proportion of aging farmers has sector and individual-level implications. Aging farmers are less efficient and productive which undermines poverty reduction and contributes to rural-urban inequality. Both of these contribute to food insecurity and growth and development of the agriculture sector. Poverty reduction for ageing society in high-poverty regions, like the Northeast, is especially important as elderly households in remote areas who live alone. Older farmers are less likely to adopt modern technology, decreasing efficiency and productivity. Aging farmers are also often aging-in-place. Rather than moving in with relatives or into a care facility, aging farmers continue to work on their farms which prevents the entry of large-

scale, more sustainable, and younger farmers to replace them. This creates a growing population of elderly farmers who are isolated and at-risk to health and financial issues.

Almost all migrant workers remit back to their families (IOM 2011). In Isaan, remittances contribute the more to household income than in any other region by a margin of over ten percent. Almost half of households in Isaan are supplemented with remittances (Yang, Wang, and Dewina 2020). Remittances were found to increase households' incomes by 17 to 22 percent and help supplement daily expenses such as food, farming necessities, and household items (Reda et al. 2012; "Overview of Internal Migration in Thailand" 2018).

Government-Sponsored Resettlement of Thai-Buddhists into Southern Thailand

State-sponsored resettlement in the first half of the 20th century fueled a wave of outmigration even before the economic boom in Bangkok. Around World War ll, the Thai government began sponsoring the resettlement of thousands of non-Muslims from the Northeast to develop the Southern agricultural sector and to dilute the concentration of Malay-Muslim populations that dominate the southernmost provinces (Islam 2006, 7-8). A series of national laws, such as the Cooperative Land Settlement Act of 1938, the Land Allocation Act of 1942, and the Land Settlement Act of 1968, represented attempts by the central government to distribute ostensibly vacant land through cooperative land settlements, or "self-help" settlements. The Department of Public Welfare under the Interior Ministry established the Land Settlement Act to permanently resettle landless farmers and provide them land, land clearing assistance, development assistance, and other services to aid resettlement (Chirapanda and Tamrongtanyalak 1980, 21). Those who qualified were given 18-25 rai (7-10 acres) to plant crops such as rubber, coconut

trees, oil palm, coffee, etc. (Haemindra 1977, 103). Qualifications for these programs included being a Thai citizen, being "well-behaved", having no land or not enough land, and having no other source of income (Chirapanda and Tamrongtanyalak 1980, 23).

Many of the land distribution programs were designed with the intention to integrate Malay-Muslim communities in the South and the rest of Thailand to promote a national identity, a pillar of the preceding Sarit regime (1957-1963) (Haemindra 1977, 103). Therefore, selection of farmers to qualify for land allocation programs was skewed in favor of Thai-Buddhists, especially for land in southern provinces (Haemindra 1977). From 1968 to 1979, the southern provinces with the some of the largest Muslim majorities at the time, Yala, Satun, and Narathiwat, had the greatest number of families settled, totally roughly 19,000 families. The next closest province that did not have a Muslim majority was Songkhla, with less than 1,500 families (Chirapanda and Tamrongtanyalak 1980, 21). A large portion of those who settled in the southern provinces under these self-help programs were from the Northeast (Haemindra 1977, 103).

What are now Thai provinces of Pattani, Yala, and Narathiwat used to be a region belonging to Malaysia, known just as Pattani. Those three southernmost states, termed the Deep South, are currently the Thai provinces with the highest concentration of Malay-Muslims. In 1902, Pattani was annexed by Siam, now known as Thailand. The annexation of the Pattani region is widely seen as the origin of the unrest that still exists today (McCargo 2009; Najish 2017). The Deep South's long history of political conflict with the Thai government was only exacerbated by the intentional movement of Northeastern Thais into the South.

The forced assimilation that followed the annexation of Pattani has long been a grievance of Malay Muslims in the Deep South. Nationally-controlled public schools replaced locally-controlled schools and all instruction was in Thai (McCargo 2009). When a constitutional monarchy replaced the absolute monarchy in 1932, the central Thai state redrew the Pattani region into the current states of Pattani, Yala, and Narathiwat (Najish 2017, 4). With the new constitutional monarchy also came a wave of Thai nationalism that helped revive the slogan, "Nation, Religion, King", which further ostracized non-Thai Muslims. These policies were funneled down into local governments which further fueled insurgency regimes when Malay Muslims continued to suffer discrimination and pressures to assimilate (Najish 2017, 5). The consistent trends of forced assimilation and socioreligious disdain of the Southern minority indicates that the movement of Northeast farmers through government-sponsored settlement programs into the South was deliberate.

Agro-Environmental Drivers of Migration

Global Climate Change

The source of the current wave of migration, global climate change, is becoming more intense and widespread. Climate scientists can determine with 90 percent certainty that heavy precipitation will increase in total, frequency, and intensity by the end of this century. At the same time, droughts are expected to increase in intensity and duration. By the end of the century, overall warming will occur with over 99 percent certainty, while global surface temperatures are 66-100 percent likely to increase by more than 1.5°C from the last 100 years. Climate scientists can conclude that human influence is the most important cause of global warming since the mid-1900s (Pachauri, Mayer, and

Intergovernmental Panel on Climate Change 2015). The data supporting the accuracy of climate models are robust. Overall, confidence intervals of climate models are higher in degree, providing substantial evidence that the data collected is increasingly likely to accurately represent the true nature of climate change. The consensus among the scientific community is overwhelming that human influence is the primary driver of increases in global surface temperature, drought, and precipitation.

Extreme weather events, worsened by climate change, accounted for the displacement of 21.5 million people between 2008 and 2016 (EJF n.d.). A 2008 estimate found that 200 million climate migrants could exist by 2050 (Stern 2007). However, more recent estimates find that by 2019, climate disasters were already responsible for 140 million displacements, outnumbering refugees fleeing war or persecution (EJF n.d.). Climate displacement creates a growing group of individuals across the globe, called environmental or climate refugees, that can be used to include both internal and international migrants. While migrants in this context are necessarily being forced from their regions, their decisions are rooted in adaptation to climate change.

Climate Effects in Thailand

Climate change in Thailand is evident and intensifying in many parts of the nation. Engagement in rice cultivation combined with the land's natural susceptibility to extreme weather events makes the country particularly vulnerable to negative economic impacts of climate change. In Thailand, over half of the workforce is involved in agriculture, while this proportion is even higher in the Northeast (Marks 2011).

In 2011, a severe drought led to a 45 percent loss in rice yields, further devastating farm incomes and livelihoods in Isaan. Exacerbated by climate change, a late start and an

early end to the prior wet season led to a drought in 2010. As a result, the Mekong River, which runs through the Northeast, fell to water levels unseen in 50 years (Marks 2011). The drought negatively affected on 7.6 million Thai in 59 of the 76 provinces, but the hardest-hit region was the rural Northeast (UNESCAP 2016). Rice cultivation is fragile in nature. The environmental disaster led to a loss of 50 percent of rural farmer's incomes (Marks 2011). The following year, 2011, was marked by an unexpectedly intense monsoon season. For 9 of the 12 months in 2011, average rainfalls were higher than the average of the last 30 years. The Thai government was not prepared for the flooding that ensued because of the volatile shift. The floods in the Northeast were further exacerbated by the government's decision to dam high volumes of water upstream of Bangkok (Marks 2011). The 2011 floods negatively impacted 13 million, with more than 800 deaths while the government spent over 46 billion USD on repairs (Gnanasagaran 2018).

Temperatures worldwide are rising due to the concentration of greenhouse gases, particularly CO2 in the atmosphere (Pachauri, Mayer, and Intergovernmental Panel on Climate Change 2015). Rising temperatures melted 46 gigatons of Alaskan glaciers each year from 2003-2010 (Patel 2020). Within the last century, sea levels have risen 12-22 cm in some areas of Thailand. Because of sea level rise that has affected low-lying areas of Thailand, the particularly harmful impact on coastal communities and the city of Bangkok has reduced the options for the migration of people from the Northeast.

Declining Northeastern Agriculture

In Isaan, climate impacts have destabilized agriculture – the main source of income for some of the region's poorest individuals. In addition to undermining Thailand's poverty reduction and food security goals, climate-exacerbated volatility in agriculture is

pressuring the Isaanese to diversify their incomes and maintain their livelihoods through rural-urban migration.

Agriculture employs nearly a third of Thailand's workforce while the only accounting for ten percent of the country's GDP (World Bank 2020b). This leads the sector to have the lowest value-added per worker (World Bank 2020b). Since 2000, agricultural productivity has remained stagnant under 5,000 USD added per worker while manufacturing has steadily increased from about 21,000 to 36,000 USD (Tangkitvanich and Bisonyabut 2015). Despite the trend of rural-urban migration driven by employment opportunities in higher value-added sectors, like manufacturing and services, the Northeast is still heavily reliant on agriculture. In Isaan, agriculture represents the main source of income for over 70 percent of the population (Yang, Wang, and Dewina 2020).

Agriculture is suffering the brunt of climate change, yet contributes relatively little to greenhouse gases in comparison to other sectors. In 2013, agriculture produced 16 percent of Thailand's total greenhouse gas emissions compared to 20 percent from manufacturing and construction, 26 percent from transportation, and 42 percent from energy (Bhuridej 2020). Increasing frequencies of extreme weather events, like drought and flooding, are causing billions of dollar equivalent in damages (World Bank 2020b).

Climate change is exacerbating chronic droughts in the Northeast. In 2019, Thailand experienced the worst drought in four decades. According to NASA, several climate-related events contributed to the 2019 drought. The monsoon season, which typically provides precipitation for much of the unirrigated Northeastern rice paddies, was shortened by five weeks and led to a decline in annual rainfall (Patel 2020). In 2019, annual rainfall fell 15 percent below average and 19 percent below 2018 (Prasertsri

2020). An El Niño event, or the ocean warming phase of a climate phenomenon known as the El Niño-Southern Oscillation (ENSO), increased surface temperatures and increased evapotranspiration rates (Patel 2020).

Increasingly unpredictable precipitation patterns and worsening droughts are exacerbating water resource management. Farm consumption accounts for 70 percent of water usage in Thailand (Marks 2011, 234). Only 7.6 percent of agricultural land in the Northeast is irrigated, leaving the rest of the rainfed land to be especially vulnerable to changes in precipitation patterns (Yoshida et al. 2019). Even irrigated lands were vulnerable to drought conditions as half of the major reservoirs in Thailand were reduced to 50 percent capacity (Patel 2020).

The Northeast's heavy involvement in rice production make the region vulnerable to climate change. Climate scientists expect rising surface temperatures to increase evaporation in rice paddies that will either increase water demand or decrease rice yields. As a result of the 2010 drought, expected rice yields fell from by 0.7 tons In years that experienced climate-related disasters, rice yields declined by an average of 45 percent while farming households lost half of their income (Marks 2011, 235). The 2019 drought resulted in a loss of 840 million USD. Rice production is expected to fall by 40 percent from MY2018/2019 to MY 2019/2020. Across the country, farmers reported production declines in 32,000 hectares due to the drought. In Isaan, farmers were forced to reduce farm densities by an average of 30 percent (N. Prasertsri and Sangpradid 2020).
Many Northeastern cities depend on fishing and coastal crop production for their livelihoods. Dams along the Mekong River have disrupted fish migration patterns and contributed to habitat destruction that is expected also to diminish fish population. At the

same time, extreme weather events like the 2010 drought led to fluctuations in water levels that led to the decline in fish abundance and even the loss of entire species (Marks 2011, 235).

Chapter III

Agro-Environmental Factors Driving Migration and Solutions

Characteristics of the Agricultural Environment of Isaan

Isaan suffers from low agricultural productivity for three main reasons, poor soil quality, variable rainfall, and exhaustive farming practices. The soil in the Northeast is mostly derived from eroded sandstone which makes it naturally sandy and lacking in nutrient content (Fukui 1996). The soil also has a low water-holding capacity. As a result, the soil is inherently low in productivity (Krongkaew 1995).

Another main contributor to poor agricultural productivity is unpredictable and irregular rainfall. In the rainy season, rainfall is highly variable in intensity and volume. In the dry season, a lack of moisture exacerbates soil erosion upon intense rainfall in the next rainy season (Krongkaew 1995). The region has long been characterized by alternating floods and droughts.

Finally, outdated, and unsustainable farming practices characterize agricultural production in the Northeast. For example, rice and cassava dominate agriculture in the Northeast, producing two fifths of nation's rice and three fifths of the cassava (Richter et al. 2005). Popular for their high yields, the monocropping systems strip the soil of its nutrients, further contributing to land degradation (Santiphop 2000).

Paddy Cultivation

Rice paddy cultivation plays a major role in supporting the incomes and livelihoods of farming households in Isaan. In addition to this, however, paddy fields also provide flood protection, support local biodiversity, and supplement rural diets.

Throughout Isaan, wild products such as various fish species, vegetables, insects, and other animals intended for consumption may be collected from paddy fields and nearby ponds, rivers, and forests. These wild products, primarily collected from rice paddies, are associated with higher economic values for rural farm households than the same amount of rice. They also provide the family and residents with valuable nutrition that may normally be scarce and expensive (Shivakoti and Bastakoti 2010).

Paddy fields have also been found to play an important role in maintaining rural biodiversity. In a study that took household surveys of a dominantly rice-farming village in Isaan, more species were found by farmers in irrigated and rain-fed rice paddies than the unfarmed environments. Irrigated paddies were more likely to support more biodiversity, likely due to the stability of the environment. Variable rain-fed farms were likely too volatile to host more species (Shivakoti and Bastakoti 2010).

During floods, paddy fields function as cost-effective water reservoirs, protecting valuable rural infrastructure from damage and maintaining stability on rural farms. Recently, paddy production has declined due to land use changes. To diversify employment by engaging in more processing and manufacturing activity, Isaan has gradually reduced the coverage of rice paddy fields. A study of one rural Isaanese provincial capital city found paddy cultivation fell by almost 30 percent in less than 20 years, while urban areas increased by over 300 percent (Shivakoti and Bastakoti 2010).

Reducing paddy fields lowers water holding capacity of the region. Wide-scale alterations to land use consistent with that of the study area could threaten Isaan's ability to adapt to future major floods.

Degradative Farming Practices in Isaan

Farming practices also contribute to the problem of increasing salinity levels which further lowers agricultural productivity. About one third of Isaanese cropland experiences high saline content (Sondergaard 2015).

In combination with naturally poor soil and sporadic rainfall, low agricultural productivity and farm incomes lead to forest encroachment. Isaanese farmers look to neighboring forests for agricultural products and for more farmland (Santiphop 2000). Forest serves as a protective barrier against soil erosion. From 1990 to 2002, forest cover in Isaan fell by two thirds, or 4 million hectares (Richter et al. 2005).

Overuse of Inputs

Due to poor natural resources and unsustainable practices, many farming households in Isaan use inputs, mainly chemical fertilizers and pesticides, to increase farm yields. The widespread use of agrochemicals occurred after the encouragement of the Thai Department of Agriculture during the Green Revolution in the late 1960s (Nelles and Visetnoi 2016). Pesticides, for example, are exempt from import duties and taxes of multiple levels of government, increasing accessibility for more small-scale farmers (Jungbluth 1997, 3). Promoting monocropping, balancing export demands, and supporting farm incomes justified the use of agrochemicals to produce higher yields (Nelles and Visetnoi 2016). This has led to the current consensus among many

policymakers and farmers that agrochemicals are still essential for sufficient agricultural production and maintaining high yields (Jungbluth 1997).

However, there are concerns regarding the use agrochemicals in Isaan and many rural communities in Thailand. The concerns include agrochemical dependency and significant health hazards.

Agrochemical dependency is an unhealthy and unnecessary use of synthetic inputs such as herbicides, pesticides, insecticides, and fertilizers primarily sold by large, private corporations (Nelles and Visetnoi 2016). Despite the presence of subsidies and tax policies, agrochemicals can send smaller-scale farmers into debt as prices increase at higher rates than crop yields (Donaldson and Moore 2017). Decades of pesticide use has also led to considerable pest resistance (Jungbluth 1997). The vastness of agrochemical use has placed farmers who do not use inputs at a significant disadvantage with competing farmers.

Heavy pesticide use also produces an inescapable presence of pesticide residue in crops and water sources (Jungbluth 1997). The World Health Organization determined the leading pesticide in Isaan, Roundup, to be a likely carcinogen (WHO 2019). In 2005, Thailand was ranked the third highest user of pesticides per unit area (Walter-Echols and Yongfan 2005). From 2003-2012, the Ministry of Public Health documented over 17,000 cases of pesticide poisoning, and farmers likely comprise almost two thirds of pesticide poisoning cases.

The Status of Conventional Irrigation

Water scarcity has significant potential to exacerbate poverty in rural regions. High poverty rates and low agricultural productivity have been linked to poor distribution

of water (Richter et al. 2005). Irrigation in Isaan is falling behind the rest of Thailand. Relative to other regions, Isaan has comparable rainfall but chronically suffers due to unequal distribution between large- and small-scale farms, and geographical challenges. Lack of water results in almost two thirds of farmland in the Northeast remaining uncultivated in the dry season (Floch and Molle 2013).

Central and subnational governments began investing in pump and gravity fed irrigation since the 1980s, when farmland was reaching its geographical limits (Floch and Molle 2015). Two rivers, the Chi River and Mun River, flow through central Isaan. However, both have very few tributaries and cannot provide for much of the region. From 1980 until 2000, 230,000 hectares of land were successfully irrigated by the development of around 1,000 small-scale pump-fed projects (Boonlue 2005). Even following the government-sponsored effort to irrigate Isaan, irrigated area totals only 1.04 million hectares out of the 10.2 million total hectares of farmland. In the Northeast, potential irrigated area totals to 3.56 million hectares. Currently, only about 29 percent of irrigable land is irrigated (MRC 2012).

Existing irrigation projects in Isaan were justified to stabilize rice production in the rainy season and enable dry season cropping. This is especially relevant as rainfall in Isaan becomes increasingly sporadic, and droughts are becoming more frequent and intense. During the dry season, households with rain-fed farms are forced to find non-farm or off-farm work to stabilize their incomes while irrigated farmers can spend more time on their fields (Shivakoti and Bastakoti 2010).

Irrigating rice cultivation was initially expected to bring farmers out of poverty by stabilizing harvests and attracting agricultural labor back to Isaan. Instead, scholars have

noted the barriers, such as declining soil fertility, groundwater availability, the rural-urban wage gap, and less irrigation availability for small farms, to this expectation. Most irrigated rice farmers were large-scale commercial farms that produced non-glutinous rice for export (Richter et al. 2005). By contrast, most small-scale farmers only producing glutinous rice for themselves did not have access to irrigated land and were limited to wet season cropping. Many saline aquifers exist along the Mekong River and its tributaries. However, groundwater volume is relatively low considering the high demand for water; these aquifers do not have nearly enough water to support wide-scale irrigation projects (FAO 2011). A rapid decline in Isaan's soil fertility indicates that agricultural expansion is not likely to play a role in attracting labor back to Isaan (Floch and Molle 2013). It is important to note here that expansion and improvement upon existing farms are separate ideas, and that expanding farms into undeveloped landscapes will not improve rural livelihoods.

Aquifer Depletion

Another potential issue for Isaan is aquifer depletion along the Mekong River Basin and its effects on the local environment and economy. About 23 percent of the Lower Mekong Basin lies in the Northeast, covering over one third of Thailand (FAO 2011; MRC 2012). Inland fisheries along the Mekong River and its tributaries support rural livelihoods, primarily through direct consumption of fish. In Isaan, annual consumption of inland fish totals to 30-35 kg per capita and 765,000 tons (Mahasarakarm 2007). A large tributary network, mainly comprised of the Songkhram, Mun, and Chi Rivers, lie within the Mekong River Basin and are responsible for draining much of Isaan (MRC 2012). The Songkhram River Basin encompasses the northernmost region of

Isaan. In addition to the three to six percent of Songkhram River Basin households who fish commercially, 80 to 93 percent fish part-time (Hortle and Suntornratana, n.d.).

Along the Lower Mekong Basin, extraction is driving river delta subsidence. Excessive groundwater extraction leads to aquifer compaction while extraction rates continue to increase. Over the past three decades, the Mekong Delta subsided an average of 18 cm. Sinking rates are only increasing, as the subsidence rates currently average to about 11 mm per year with some places sinking up to 25 mm per year (Minderhoud et al. 2017). The rising subsidence rate and the Mekong's low elevation leave the region increasingly vulnerable to salinization, permanent inundation, storm surges, and, most importantly, flooding.

Groundwater extraction rates along Thailand's portion of the Mekong River Basin is relatively controlled, but still represents potential issues for Isaan. Aquifers holding large amounts of groundwater may be tempting to extract. However, the water is 20,000-30,000 years old and not recharged by rainfall (FAO 2011). They are at serious risk for overexploitation. Because of subsidence, extraction to meet irrigation demands in Isaan could leave the region even more vulnerable to flooding.

Limited Farming Opportunities as a Push Factor for Rural-Urban Migration

Much of the literature has cited the poor agricultural performance in Isaan as a factor for the rural-urban migration plaguing the region's youth. Household land holding size has been found to be a determinant of rural-urban migration. Land holding size decreases the likelihood of migration for larger landholders (Zhao 1999). Exclusively rice-producing households are more likely to have their younger family members migrate (Piotrowski, Ghimire, and Rindfuss 2013). This is likely due to the risk associated with

growing a single crop in an unpredictable environment, such as the Northeast. Households that grow other crops, like cassava, are less likely to send migrants into cities. Access to sufficient capital from the sale of crops is typically great enough to eliminate the need to migrate (Piotrowski, Ghimire, and Rindfuss 2013).

Irrigation may also pose a factor for migration. In farming households where farms have relied on rain-fed pump irrigation, the incidence of migration has increased. In this case, urban migration is likely a way to afford irrigation maintenance and capital costs (Piotrowski, Ghimire, and Rindfuss 2013).

Agro-Environmental Solutions

The World Bank estimates that if Isaanese farmers were as productive as other regions in Thailand, the Northeast would raise their national share of agricultural output from one fifth to one half (Richter et al. 2005). Reforming farming practices in Isaan is a vital component of the solution to reverse the wave of rural-to-urban migration that is destabilizing the Northeast.

Outmigration of much of the youth workforce is due to Bangkok's demand for labor necessitates reinvigorating employment opportunities in Isaan. In addition, the Southeast Asian region is known to be one of the fastest aging populations in the world, narrowing the opportunity for action in Isaan (Rigg et al. 2020). The tendency of older people to avoid new technology, thereby stunting productivity, creates a demand for short-run solutions. Time presents a significant limiting factor in the discussion of solutions to farming households. This involves both developing new industry and revitalizing the underperforming farm sector. However, developing manufacturing and processing

centers must be done sustainably. The effects of rapid development on the environment are already surfacing.

Two approaches to farm reform have been proposed in the past decade: Climate Smart Agriculture (CSA) and Regenerative Agriculture (RA). Both will be vital to attracting farm labor back to Isaan. There are two major issues at hand. The first is the lack of farm labor in Isaan. This is a short-term issue, for which CSA is most equipped to overcome.

Climate Smart Agriculture focuses on promoting agricultural practices that increase productivity and climate resilience. Increasing productivity will be very important in drawing labor back to Isaan in the short run. CSA is better funded than RA because their donors are typically corporations, well-established NGOs, and international financial institutions that are emphasizing projects that maintain production levels, even if they do not adopt all of the measures to regenerate soil health (Thompson 2020).

Climate smart agriculture operates according to three main pillars: productivity, adaptation, and mitigation. Productivity aims to sustainably increase agricultural yields and farm incomes. The productivity pillar of CSA emphasizes sustainable intensification, which involves increasing farm productivity within existing farms while alleviating farming practices that strain the environment. The second pillar, adaptation, prepares farmers to adapt to shocks and long-term changes. This develops farm and climate resilience and reduces farms' exposure to short-term risks. The adaptation pillar also aims to preserve vital ecosystem services that many farm households rely on for proper nutrition, flood protection, and water filtration. The mitigation pillar of CSA involves maximizing carbon sequestration and maintaining carbon sinks. This primarily consists

of farming practices that significantly reduce or actively remove greenhouse gases, severely limit deforestation, and maximize carbon uptake in soils and forests ("Irrigation for Smallholder Farmers" n.d.).

Regenerative Agriculture aims to reform farming practices in highly contextualized settings in order to improve soil health, reduce farm-based greenhouse gases, and increase climate resilience. Regenerative Agriculture is a promising longer-term solution for Isaan because it foremost prioritizes soil health, a major limiting factor for growth among smallholder farmers. Once farmers can stabilize farm incomes, improving sustainability of the industry can be prioritized through Regenerative Agriculture. Implementing appropriate farming practices for the salinity of the groundwater, the sandy soil, and the variable rainfall in Isaan will be included in RA. The intention is to execute changes that allow the natural ecosystem and farmlands to coexist, using farming techniques that contribute to the natural systems rather than deprive them. This approach, however, only allows for projects that directly improve the long-term health of the ecosystem (Thompson 2020). Faced with widespread poverty and a dwindling supply of young labor, Isaan is not likely in a position to sacrifice the immediate well-being of their rural poor to improve their environmental health, which will likely not be realized for decades.

Climate-Smart Agriculture

Implementing water-saving changes through CSA farming techniques in Isaan will play a major role in building farm resilience and boosting productivity. More than 40 percent of the world's rural population lives in river basins that are considered "water scarce", and the Mekong is no exception. Farm vulnerability is directly related to its

dependency on the water cycle (FAO 2011). With over 70 percent of Isaan relying on rainfed agriculture, the farming system is highly vulnerable to climate disasters (MRC 2012). Isaan has already experienced increasingly high incidence of floods, droughts, and unpredictable rainfall. Climate change is expected to continue this trend by further increasing rainfall variability, annual precipitation, and interannual variation. Climate scientists also predict increases in frequency and intensity of floods, rising evapotranspiration rates, and increases in river discharge by over 20 percent. Water scarcity is also heavily impacting the natural environment with biodiversity observed to be declining rapidly for fresh water-dependent species (FAO 2013).

Adaptation to these changes will demand amendments to Isaan's farming system. Building farm and climate resilience will involve improvement upon the conservation of soil moisture, drought protection, and soil moisture retention capacity.

Supplementary irrigation

Supplementary irrigation offers a solution for conserving soil moisture and improving drought protection schemes. It is defined as "the addition of limited amounts of water to essentially rainfed crops to provide sufficient moisture for normal plant growth" (Oweis, Prinz, and Hachum 2012). Supplementary irrigation exclusively provides irrigation during instances of rainfall deficits and often during critical growing stages (FAO 2011). The FAO promotes supplementary irrigation as a climate-smart practice that increase farm resilience and helps farmers adapt to changing climates. Supplementary irrigation contributes to productivity by increasing yields and crop output per unit of water, known as water productivity. Supplementary irrigation contributes to the adaptation pillar by improving access to water, reducing dependency on rainfall, and

reducing farmers' sensitivity to shocks such as droughts and floods (FAO 2013). Ultimately, supplementary irrigation also reduces greenhouse gas emissions. Higher yields lead to increased plant biomass, which means increased rates of carbon sequestration per hectare (Nangia et al. 2018).

The practice is noted as almost opposite to traditional irrigation (FAO 2011). Where irrigation provides the primary water source, supplementary irrigation only acts as a supply for soil moisture during dry spells (Rockström et al. 2007). Supplementary irrigation focuses on rainfed systems in the subtropics, as these regions will be the most impacted by changes in precipitation patterns and mean annual temperatures (FAO 2011). For these systems, these changes bring increasing frequency of crop failure and variation in soil moisture (FAO 2013).

Irrigated land more than doubled between 1961 and 2009 (FAO 2011a). This trend is only expected to continue as climate impacts growing increasingly unpredictable. The expansion of traditional irrigation projects has led to agricultural intensification that account for over 70 percent of worldwide aquifer withdrawals (FAO 2013). While irrigated farm systems provide better protection against rainfall variability than non-irrigated farms, they require increasingly large water storage capacity in response to increasingly frequent droughts, floods, and variable runoff distribution (FAO 2013). Traditional irrigation is also more expensive, more technologically demanding, and can require more energy if the land is not suitable for gravity-fed irrigation. Others have also noted the low likelihood of irrigation adoption due to poor access to aquifers and the slow recharge rates (Floch and Molle 2013; FAO 2011).

Supplementary irrigation is effective in reducing yield losses, boosting productivity, higher water productivity, and decreasing the risk of crop failure (Nangia et al. 2018). Trials of supplementary irrigation increased yields 140 percent in Syria, 26 percent in Morocco, and almost 55 percent in Iran. Dry spells often occur during the most critical stages of crop production and supplementary irrigation has found to effectively reduce the stress of the rainfed crop yields by providing moisture during these times (Rockström et al. 2007). Providing relatively small additions of water to rainfed crops have also been found to significantly increase crop yield (Oweis, Prinz, and Hachum 2012). Supplementary irrigation also can aid early sowing, which leads to a longer growing season and a higher yield. In Isaan, farmers will sow their land when there is sufficient precipitation called "onset rainfall", or the beginning of the rainy season. Every week onset rainfall is delayed, yields fall by 200-250 kg/ha. Supplementary irrigation can provide enough additional water to allow farmers to seed their land on time (Nangia et al. 2018).

A successful supplementary irrigation project demands local-level knowledge of the crop, landscape, and climate. To use supplementary irrigation, farmers need to know how much water a crop needs so that a deficit is supplied with the correct amount of additional water. Supplementary irrigation involves excavating a catchment area where both rainfall and runoff can be collected. The capacity of this reservoir should be enough to meet the expected demand of the crop. This demand should only provide enough to either increase yields or prevent a crop failure during a dry spell (Nangia et al. 2018). Finally, if the landscape does not permit constant flow or gravity, it cannot distribute water throughout the entire farm, sprinkler systems or drips may be necessary. Adoption

of these technologies in Isaan will likely be dependent upon low installation and maintenance costs. Implementing even supplemental irrigation systems represent a significant investment. The FAO recommends solid set or moving sprinkler systems over drip irrigation although both can be costly. For smaller-scale farms, manual distribution is also a cheaper, but more labor-intensive option. In Ghana, water from small-scale supplementary irrigation systems is distributed using watering cans or hoses connected motorized pumps (Nangia et al. 2018).

The cost of supplemental irrigation represents the most significant barrier to adoption. In Syria, 69 percent of farmers involved in the trial stated their primary reason for non-adoption were high costs (Bader, Jouni, and Shideed 2011). Large financial institutions, such as the World Bank and the Global Environment Fund (GEF), are funding large-scale irrigation projects in Thailand and South Asia. While the World Bank is not currently investing in CSA in Thailand, they are investing in China, Vietnam, Cambodia, Philippines, and in some parts of the Lower Mekong River Basin (World Bank n.d.). The GEF has trust funds earmarked for CSA and most recently funded the Small Grants Program in Thailand. From 2018 to 2019, the program provided grants for community organizations lacking sufficient financial resources to plan, manage, and implement rural land- and seascapes to build socioecological resilience. The program focused on changes that maintained biodiversity, combatted climate change, and limited land degradation in all four regions of the country. In Isaan, agriculture was noted as an "extremely problematic" factor in land degradation. Much of the plateau of the Lower Mekong River Basin has been deforested due to agriculture. The project specified land degradation due to soil erosion as the most serious threat to developing sustainable

agriculture. Climate-Smart Agriculture was cited as one of the changes that would help Thai citizens, the Thai government, and the GEF reach the goals of this project. Together, the GEF, local community service organizations, the Thailand Land Development Department, and the UNDP provided $10.5 million in grants (GEF 2020)

Integrated pest management

Reducing farmers' reliance on non-renewable, external inputs, and instead, enhancing the natural biological process that perform the same functions is a vital aspect of CSA. Integrated pest, disease, and weed management is a common tool of CSA to prevent and remove infestations while maintaining the health of the local environment and ecosystem services. Farms throughout Southeast Asia have observed an outbreak of pests and diseases alongside increases in temperatures (ADB 2009). Climate Smart Agriculture involves the direct inspection and monitoring of crops for damage, the use of mechanical devices, biological pesticides, such as naturally existing predators and pathogens, and chemical pesticides as a last resort (Lasco et al. 2011). The FAO Asian Regional IPM/Pesticide Risk Reduction Program was implemented from 2007 to 2018 in the Mekong Region in Cambodia, Lao People's Democratic Republic, Myanmar, Vietnam, and Thailand. The goals of the project were to eliminate pesticide overuse, reduce reliance on pesticides, and use of WHO Class I pesticides (FAO 2020). Class I pesticides are categorized as "extremely" and "highly" hazardous using the GHS' Acute Toxicity Hazard Categories (WHO 2019). The project successfully increased awareness of the problems associated with pesticide overuse, banned and phased-out highly hazardous pesticides, and reestablished IPM. Some practices that aided this transition

involved mixed cropping, increasing accessibility to bio-controls, encouraging potato cultivation to reduce labor required for crop establishment, and weeding (FAO 2020).

Crop-related amendments

Crop variety is another aspect of farming that must adapt to rapidly changing climates. Changing crop variety according to CSA involves selecting a different crop over another in response to climatic stressors – choosing crop varieties that can withstand a larger range of environments. In Vietnam, commercial rice farms switched to rice varieties with shorter growth cycles, allowing farmers to produce two yields rather than one within the rainy season along the Mekong Delta (Lasco et al. 2011).

Changes such as this may pose special issues for Isaan. Farmers must have knowledge of climate forecasts, accessibility of resilient crops, and acceptance of the particular rice variety (Snidvongs 2006). Rice variety is a key aspect to Isaanese culture. Given that many Isaanese farming households produce for themselves, transitioning away from the culturally significant varieties may be a challenge.

CSA also suggests changes in cropping pattern and cropping schedule. Changing cropping pattern involves the addition or removal of more resilient crops or changing how certain crops are planted in a season. The choice of crops is dependent upon the most pressing local climate stressors. Many Southeast Asian farms incorporate various bean varieties, maize, and sorghum that improve yields and nutrient cycling (Lasco et al. 2011). Cropping schedules may change according to observed climate changes. In practice, this can be harvesting earlier or delaying seeding.

Genetically modified foods varieties may also provide a solution for Isaan. Rice is a crop that has been extensively researched to improve climate resilience. The

International Rice Research Institute isolated a waterproofing gene in rice called Sub 1A. Inserting this gene into other rice varieties allows them to survive being completely submerged for two or more weeks in some cases (Lasco et al. 2011). The gene has been bred into rice cultivars in Bangladesh and India. Genetic modifications have produced higher yields and minimized decline in yields due to flood (CGIAR 2007). GMOs may be especially important for Isaan because it can help save rice yields from floods, which are increasing in frequency due to climate change.

Debates regarding genetically modified crops often note the environmental, agricultural, and corporate issues that can accompany their adoption. If applied incorrectly, GMOs can increase reliance on chemical inputs, pollute the soil, and unintentionally spread modified genes (Khan et al. 2012).

Despite these well-known concerns, GMOs continue to rise in popularity. In 2019, 190 million hectares of GMOs were planted in 29 countries, 19 of which were developing countries. This hectarage represented an increase of almost 6 percent from 2015 (GLP n.d.). Much of the use is dominated by industrial farms in the US, Brazil, and Argentina (The Royal Society 2016). However, developing countries have begun to adopt genetically modified crops. Kenya, Zimbabwe, Zambia, Cuba, India, Burkina Faso, and Eswatini have slowly adopted modified corn, soy, and cotton (GLP n.d.). Defenders of the use of GMOs in appropriate settings (such as developing countries) continue to emphasize that genetically modified crops must be reframed to address food security and recover low agricultural production. GMOs, when implemented appropriately, produce higher yields with greater tolerances for climatic stressors, herbicide resistance, and improved nutritional quality (Dibden, Gibbs, and Cocklin 2013).

Southeast Asian countries that currently grow genetically modified crops include the Philippines, Myanmar, and Vietnam (GLP n.d.). The Philippines was the first country to approve the commercial cultivation of GMOs for food and feed in Southeast Asia. The Philippines desperately adopted genetically modified corn when farmers reported 30-50 percent yield losses due to pests, which severely disrupted the country's corn production. Currently, more than 400,000 farmers plant genetically modified corn, cotton, eggplant, and Golden Rice in the Philippines (Isaac 2019). Recently, Vietnam's agriculture ministry approved the imports of four genetically modified corn varieties with the goal to have 30-50 percent of the country's farmland covered by GMOs by 2020 (Leung 2014). Both countries now import genetically modified crops and pesticides from agricultural biotech giants.

The solution to producing genetically modified crops appropriately may be the education of farmers through agricultural extension agents. Agricultural extension agents are directly responsible for disseminating information about new agricultural technologies, and techniques to local agricultural communities. Agricultural extension aims to develop farmers' agricultural knowledge to strengthen food production in quality and quantity, and buffer farmers from harmful downturns.

In Thailand, The Department of Agricultural Extension aims to implement nonformal education for farmers with the goal of maximizing farm efficiency with capacity, while improving quality of life and independence. Local agricultural agents are organized by province and district. They actively educate farmers, encourage them to learn and adopt new technologies, and show them how to teach others (Shah, Asmuni, and Ismail 2006). Agricultural extension agents should actively educate farmers on how

to avoid the issues associated with GMOs along with their adoption. Supplying these resources for local farmers could help ensure that farmers and other citizens of Isaan reap the benefits of genetically modified crops.

Regenerative Agriculture

While CSA offers a promising short-term solution due to the consideration of farm income and farm productivity, regenerative agriculture emphasizes the long-term reform of conventional farming practices. Regenerative agriculture is inherently soil-focused. The goal is stabilizing food systems and combat climate change by improving soil health and maximizing GHG sequestration in the soil. Regenerative agriculture accomplishes these goals by improving the existing biological processes in crop and livestock that naturally increase fertility and soil organic matter in hopes to draw farming practices away from agrochemicals (Setboonsarng and Gregorio 2017).

Regenerative practices revive biodiversity of microorganisms in soils to digest and decompose plant and animal matter, which increases soil fertility. Increasing microorganism diversity in the soil also provides other vital ecosystem services, like soil formation, local atmospheric regulation, water filtration, and the maintenance of soil productivity. The presence of many species of microorganisms in soils regulates pest populations by reducing the change that some species will outcompete others. In a long-term farm trial of regenerative and organic (no chemical use) farming, the Rodale Institute found that by 27 years, carbon content in soil increased by 30 percent (Setboonsarng and Gregorio 2017). Microbial life successfully stabilizes soil carbon and sequesters atmospheric carbon.

Regenerative agriculture will be desperately needed in the face of growing climate impacts in Isaan. Most of the issues plaguing Isaanese farm productivity are climate related. However, some changes included in regenerative agriculture increase costs but to not increase crop yields. In these cases, these practices are not likely to be adopted in Isaan due to the negative affect they would have on farm incomes. If carbon credits could be secured, mitigating, and combatting climate change once Isaanese farms have stabilized will mean that the Northeast could even gain financially by reducing GHG emissions and maximizing carbon sequestration.

Chapter IV

Recommendations to Capture the Benefits of Agglomeration

While investing in rural development is important, it is also vital to understand the tendency towards agglomeration in order to address appropriate policy action. It is important to note that the concentration of people in an urban area itself is not inherently an issue, and, in fact, is likely to enhance economic growth and overall welfare (World Bank 2009). Rather, it is important to address the side effects of rapid urbanization that create in inequality and deprivation. Large, overpopulated metropolitan areas often provide economic goods like services, research and development, and manufacturing (Henderson 2002).

Much of the recent literature suggests that, in developing internal migration policies, many have underestimated the benefits of agglomeration and the associated spillover effects. Moreover, migration abatement policies have been found to have little effect on reducing flows from lagging to leading cities (World Bank 2009, 158). The larger effect these city size and movement restrictions is limiting economic growth and slowing the pace of convergence of welfare throughout the entire country. In China and India, policies that restricted city size suffered welfare losses due to forgone growth (World Bank 2009, 162). Rather than limiting internal population movements, especially those motivated by labor, governments should be passive with respect to voluntary

urbanization, as it leads to more growth and a faster distribution of better living standards (World Bank 2009, 161).

Allowing agglomeration to occur also allows for the emergence of the associated spillover effects. In addition to sending back remittances, they communicate new ideas about governance, business knowledge, and technical support (World Bank 2009, 159). New ideas about appropriate governance can assist rural communities to better advocate for their needs. By raising the earning of those who move, labor migration also contributes to overall growth of the economy by equalizing labor distribution. This leads to further clustering of people, thereby concentrating human capital. Countries that experience high rates of internal migration associate these waves with periods of consistent economic and welfare growth, as was the case for Brazil for the 25 years after major internal labor movement began (World Bank 2009, 162). Internal migration policies that can capture these benefits and spillover effects from clustering by facilitating these movements will likely increase rates of welfare convergence between lagging and leading cities.

Those who migrate from lagging cities tend to maintain strong connection to their homes. Thus, remittances play a large role in the supporting the incomes of the families left behind in lagging cities. By 2009, they outpaced other primary capital flows to poorer regions in developing countries (World Bank 2009, 162).

Labor migration is attractive to many migrants because it offers a means for those who have invested in education to realize those returns. These returns to human capital are highest where human capital is abundant, and human capital tends to agglomerate, geographically, where the economy thrives (World Bank 2009, 158). This helps explain

why, in many instances, migrants tend to have higher levels of education and better-off financially. This provides further evidence for a need for governments to adopt a passive approach, rather than discourage internal labor movements.

An Introduction to Secondary Cities

Secondary or satellite cities are smaller metropolitan areas adjacent to larger urban centers, but have distinctive political, social, and economic structure. Secondary cities, by definition, can range from population sizes as low as 100,000 to the second largest urban center in the country (Rondinelli 1983). Among developing countries experiencing unplanned growth, secondary cities represent the fastest growing urban regions ("Secondary Cities" n.d.).They are often successful in alleviating population pressures through fiscal and industrial deconcentration. When secondary cities can raise their own financial resources, they can help provide public services like interregional transportation and telecommunications to compete with major, overpopulated cities (Henderson 2002). Many mature, highly functional metropolitan systems ultimately reach this equilibrium and decentralize into small- and medium-sized outlying urban systems.

Case Study: Outmigration from Northeast Brazil

Thailand's response to internal migration has not fully taken advantage of the benefits of agglomeration. By contrast, Brazil managed internal migration that captured many of these benefits of agglomeration. The case demonstrates a passive approach to internal labor migration that maximized the benefits of urbanization through the development of secondary cities. Some of Brazil's approaches ought to be considered for Thailand.

Like Thailand, Brazil experienced rapid urbanization and industrialization during the latter half of the previous century. Higher wages and the opportunity to send remittances back to their home regions, paired with increasing labor demands of industrializing urban centers, drove heavy rural-to-urban migration, primarily from the Northeast to the Southeast of Brazil. In 50 years, the urban population grew 45 percent, peaking during the 1960s and 1970s (E. F. de L. Amaral 2013). Northeast Brazil consistently suffers from the highest rate of rural poverty and outmigration, which can be attributed to inadequate water accessibility, infrastructure, and off-farm employment opportunities. Altogether, deprivations in the Northeast have led to economic stagnation and the decline of rural welfare.

Unequal distribution of land also contributes to high rural poverty rates. Nine out of ten farmers in Northeast Brazil are smallholders with farms smaller than 100 hectares. Smallholders account for just 30 percent of the agricultural production area, yet produce 70 percent of food crops for the country, including maize, beans, manioc, rice, cashews, cotton, fruits, and vegetables (Sietz et al. 2006). Unequal land distribution has also contributed to smallholders relocate into regions less fit for farming, advancing the rate of environmental degradation (Sietz et al. 2006).

Similar to Isaan, Northeast Brazil also suffers from climate-related issues such drought, flooding, poor soil, variable rainfall, and desertification. From 2012 to 2015, a severe drought destroyed wide ranges of cropland and heavily disrupted the cattle farming industry (Marengo, Torres, and Alves 2017). Climate models in the region predict significant increases in temperature and declines in total precipitation. Combined with the region's tendency toward dry spells, climate projections indicate increasing

frequency and intensity of droughts. This, in consideration with the positive feedback loop created by increasing evaporation rates has led climate scientists to label Northeast Brazil a hotspot for potential desertification (Marengo, Torres, and Alves 2017; Eswaran, Reich, and Beinroth 1999).

Efforts to rectify unequal land distribution, implement irrigation schemes, develop infrastructure, and provide human and technical resources were largely unsuccessful, inefficient, or both (Sietz et al. 2006). A state -run water policy program, called PROHIDRO, aimed to support investments that improve accessibility of water in drought conditions and to involve the federal government in rural water policy (World Bank 1983). The Special Program for the Development of the Semi-Arid Region of the Northeast also aimed to alleviate the effects of chronic drought. One of the larger rural development programs in the state of Bahia in Northeast Brazil was known as POLONORDESTE, which sought to integrate many of the individual development efforts in the region. It was implemented in a top-down manner through on federal, regional, state, and local levels with the objective to reduce rural poverty, improve rural employment opportunities, and improve agricultural productivity (World Bank 1984). The range of development projects included land redistribution, the provision of rural and agricultural extension, climate adaptation research, implementation of an agricultural credits system, farm protection schemes, irrigations schemes, municipal road building, improvements in formal education, and health care services (World Bank 1983). The World Bank funded nine poverty-oriented projects involved from 1975 to 1982, totaling US$283.7 million under POLONORDESTE. Despite this intervention, the program was

still largely criticized for its issues with poor organization, coordination, and design, especially in its implementation (World Bank 1984).

The development of Brazilian secondary cities

Failure to converge welfare via in situ infrastructure and agricultural development combined with a massive flow of migrants from lagging to leading cities all over the country (still primarily the Northeast), led to the development of secondary cities in the Southeast. Secondary cities in Brazil thrived mainly due to a lack of government intervention in internal labor movements, unabetted urbanization, and active encouragement of international labor migration (Amaral and Fusco 2005).

Secondary cities in Brazil tend to fall into two categories: regional networks and clustered cities. Regional networks are cities that often act as centers for local government, industry, or tourism. They have strong connection to national and international trade with a growing and dynamic local economy (Roberts and Hohmann 2014). An example of this in Brazil is Curitiba, extending along a growing transportation route called the Southern Mercosur Economic Development Corridor that connects Chile, Argentina, and Brazil. The city provides goods and services for commercial, industrial, and tourist activity that occurs along the corridor. It is part of an existing network of secondary cities in Chile and Argentina (Roberts and Hohmann 2014).

City clusters are often associated with urban expansion driven by labor migration and booming manufacturing centers. In Brazil and many industrialized countries, development is driven by the establishment of trade export centers along international sea ports (Roberts and Hohmann 2014). Many secondary cities surround São Paulo. On the outskirts to the southeast, seven local governments and three large secondary cities, Santo

André, São Bernard do Campo and São Caetano do Sul are home to 2.7 million (Ceppi 2020). The cities are highly interconnected due their proximity to São Paulo and the Port of Santos. This coastal region hosts 24,000 companies that employ 26 percent of the working population of the three secondary cities (Ceppi 2020). Only 13 percent of the secondary city residents commute to São Paulo for work. If the region were combined into a city, it would account for one fourth of the country's GDP (Ceppi 2020).

Secondary Cities in Northeast Thailand

While many of Brazil's secondary cities develop around large urban centers in the southeast, such as São Paulo, Isaan may reap more benefits of agglomeration if secondary cities were established or expanded in the Northeast. Isaan has four growing cities that may fall under the definition of a secondary city, known as Isaan's "Big Four". These include Khon Kaen, Nakhon Ratchasima (Korat), Udon Thani, and Ubon Ratchathani. These secondary cities have large, well-established universities serving populations between 500,000 to 780,000. As elaborated below, several factors contributed to the success of Khon Kaen, including the construction of several major infrastructure projects, the opportunity for local entrepreneurship, and the trend of public-private partnerships. There is significant potential for Isaan to grow and establish cities to capture the convergence of welfare and spillover effects that result from agglomeration.

The most important infrastructure development began in the late 1950s. As part of a major U.S. aid project, the first road to span the northeast region was created in 1958. The road established a connection between Northeast to Bangkok, promoting economic and rural development and proving a corridor for rural-urban migration (Pechpakdee 2020). In the 1960s, the Electricity Generating Authority of Thailand (EGAT)

implemented the Ubol Ratana Dam, the first hydroelectric dam in northeast Thailand. Just about 30 miles from Khon Kaen, the dam produced enough energy to support large-scale industry, leading to the establishment of several factories near Khon Kaen (Pechpakdee 2018). The dam now serves as a hub for electricity generation in the northeast region (EGAT n.d.).

The establishment of Khon Kaen University served as the first public university in Northeast Thailand, and continues to lead the region in tertiary education (Pechpakdee 2018). The university was established with an agricultural and engineering specialty to help provide resources for these professions in the Northeast.

The road, dam, and public university provided a strong base for the secondary city. However, the recent activity that followed contributed most to the city's growth and development. Khon Kaen used various infrastructure projects, led by municipal government, local researchers, and local business leaders to attract people and business to the Northeast (Pechpakdee 2018). This system of growing the city through locally-funded infrastructure projects is known as the Khon Kaen Model. The establishment of the Northeast Railway further connected Nong Khai and Ubon Ratchathani to Bangkok, passing through eight northeastern provinces along the way (Pechpakdee 2020). The railway's construction made Khon Kaen the first city, separate from Bangkok to have its own rail system (Natanri and Kongrut 2018). Again, the infrastructure project further contributed to the region's socioeconomic development through demand for products, services, and travel-related business associated with the railway. The project is regarded as the single-most accelerating development project associated with the emergence of Isaanese secondary cities (Pechpakdee 2018). Most recently, the construction of an

international wing at the Khon Kaen airport is expected to further connect Isaan to international travel and trade. Due to reduced transportation time and costs, secondary cities can rapidly increase capital and resources with the addition of airports (Song 2013). The wing represents only the second international connection to Isaan after the airport in Udon Thani (Pechpakdee 2020).

Another reason for Khon Kaen's growth was that, unlike other secondary cities in Isan, it did not form as a remnant of a *monthon*, administrative hubs established as governance structures in the early 1900s. Governing elites in *monthons* often hoarded much of the wealth and land ownership, which established generations of noble elites that endured the dissolution of *monthons*. The absence of class privilege led to the emergence of an upper class of business owners and government officials native to Isaan, went to Khon Kaen University, and/or attended university in Bangkok and returned (Pechpakdee 2018). As a result, the upper class are united by a sense of regional, Isaanese pride. Khon Kaen was able to grow in population size much faster than other Isaanese secondary cities, despite originating with relatively low population density because it took a passive approach to labor migration, even from bordering countries. The result was the agglomeration of diverse population in search of economic opportunity.

A long history of neglect from the central government led local private entities to partner with public institutions to provide public services (Pechpakdee 2018). Beginning in 2000 with the induction of a new mayor, Khon Kaen's municipal government, in addition to a genuine dedication to political participation, operated under a philosophy that development of the city must rely on cooperation with civil society, and the scholarly community (Pechpakdee 2018). The result included multiple partnerships between local

government and Khon Kaen University, most consequentially the Smart City Initiative. The municipal government and Khon Kaen University Faculty of Architecture collaborated to help modernize and improve technological accessibility across Khon Kaen across various aspects of public services (Natanri and Kongrut 2018).

Finally, Khon Kaen's central location, strong basis of infrastructure, and leading university made it attractive to investors and allowed the city's leaders to develop a private sector-driven approach to development in addition to the trend of private-public partnerships. Famously, a group of 20 leading "new gen" business leaders invested 10 million baht (US$320.5 million) each to fund a new light rail system to advance mobility within the city (Pechpakdee 2018).

To urbanize Isaan, cities in the Northeast with established universities and strong infrastructure provide possible starting points for secondary cities. As the Khon Kaen Model demonstrated, however, infrastructure may have to be established with leadership and financial support from the private sector. Historically, funding from the central government for infrastructure projects for the benefit of Thailand's Northeastern residents has been scarce. Isaan has some of the poorest infrastructure with the lowest rural road density per capita. Per capita public expenditures in 2002 and 2003 were almost 40 to 50 percent lower than all the other region (Richter et al. 2005, 166).

In addition to the Big Four, Kalasin and Maha Sarakham both have universities and adequate infrastructure that could provide the means necessary for greater rates of urbanization. Kalasin, the capital of Kalasin Province with a university that was established in 2015, has a population of only 35,000 residents, but has a central

geographic location between other secondary cities. The growth of the university will likely contribute to the urbanization of Kalasin in the new few decades.

Maha Sarahka, is the capital of Maha Sarahkam Province, boasts the largest university in the Northeast, serving 37,000 students in addition to six small universities in the area. With just over 50,000 people, the city is a growing tourist destination, has a central location in Isaan, yet lacks connective infrastructure, such as railways or airports. This is likely a reason why, despite abundance of educational opportunities, population in Maha Sarahkam has fallen by over 20 percent since 2000 (Corbane et al. 2018). Both Kalasin and Maha Sarahkam represent significant opportunities for becoming secondary cities, but lack connectivity to Thailand's largest urban centers. Building them up with infrastructure while maintaining an indifferent attitude towards migrants will likely result in the urbanization of the cities, thereby increasing the pace of the convergence of welfare in Isaan and thereby Thailand.

Building up potential or existing secondary cities around Bangkok may also help seize the benefits of agglomeration, but there are some barriers that could be avoided if cities in Isaan were developed instead. First, classism in Bangkok is profuse and contributes to the limited worked opportunities that the Laotian-accented, darker- -skinned Isaanese labor migrants face. Differences in language, religion, ethnicity, and race play major roles in prohibiting the movement of labor migrants (World Bank 2009, 80). With about half of the minority ethnic groups living in Isaan, fear of discrimination from of their accents and skin color can be barrier to migration, preventing welfare convergence and increasing inequality (World Bank 2009, 80).

Historical Examples of Intervention in Internal Movement

Historically, Thailand has engaged in activities that deliberately or consequentially interrupted the organic flow of migrants throughout Thailand. With regard to the Northeast, the Thai government has facilitated settlement of rural Isaanese farmers in the Malay-Muslim dominated South. In Bangkok, methods of urban exclusion perpetuate the marginalization of the city's poor, most of whom are rural migrant from Isaan.

A primary way in which the central government has facilitated movement out of Isaan and into the South is through self-help land settlements. The government-sponsored settlement was executed, in part, to address the population disproportion of Thai-Buddhists and Malay-Muslims by establishing a population of ethnically Thai residents along the Thai-Malaysian border (Chirapanda and Tamrongtanyalak 1980, 21). Criticism from Muslim communities came when provincial authorities responsible for selecting citizens who qualified for the program overwhelmingly selected Thai-Buddhists from the Northeast to settle land in the South over local Muslims.

Various forms of urban exclusion in Bangkok exist that disproportionately negatively affect the urban poor and spur movement within and out of urban spaces. Some examples of urban exclusion are "regimes" of paperwork, the notion of sufficiency economy in Thai development policy, and beautification projects.

In Thailand, exclusion by paperwork involves the excessive amount of red tape that accompanies land use in urban spaces (Harms 2016, 46). Existing urban residents often support politicians who work to achieve formal land titles to urban spaces, reducing land available to migrants. While regulation can develop land security for some of the

residents, it can also bury poor populations in paperwork, and facilitate dispossession as regulation can easily result in the commodification of coveted urban land. (Harms 2016, 47).

The relatively recent emergence of the Buddhist ideal of moderation and sufficiency in economic markets, called sufficiency economy, has been the backbone for development policy in urban spaces since the 1997 financial crisis that originated in Thailand. Sufficiency policies inherently pin culpability of the crash onto social shortcomings of "excessive desires" and greed (Elinoff 2014, 89). Sufficiency discourse reconsiders the demands for formal rights and urban consumer inclusion of the urban poor as consequences of the absence of Buddhist ideals (Elinoff 2014, 90). The result in development policies are small-scale projects that are intended to promote sufficiency, but have little impact on curbing unabetted economic growth. The small scale of these projects indicates a tendency of sufficiency economy not to transform the economy of a state- or even a city-level, but rather to targets individuals and communities. This can lead to the justification of their marginalization by the fact that they must develop these notions of moderation to become citizens worthy of political participation (Elinoff 2014).

Some of these small-scale projects included beautification projects, which were part the wave of "clean, green, and beautiful" urbanism that swept across Asia (Harms 2016, 51). Beautification projects have been implemented, largely on behalf of the middle and upper classes in Bangkok, to modernize the city without regard for the effects on the urban poor (Herzfeld 2017). The same neoliberal politicians who support formal rights for rural migrants contribute to these projects that ignore well-established living spaces in urban areas (Harms 2015, 47). The projects force marginalized populations out

to the farthest and most unsanitary slums in the process, driving homelessness and a growing attitude of resentment toward middle and upper classes (Herzfeld 2017). While developers and investors continue to accumulate profits to serve short-term interests, beautification projects directly result in the destruction and suppression of cultural traditions among the urban poor in Bangkok (Herzfeld 2017). Insofar as potential migrants are aware of the poor conditions in the city, they are more likely to be deterred from migrating. Thus, urban exclusion contributes to the decline in welfare among rural labor migrants already in the city and those considering migration, who consequently withhold agglomerating.

Chapter V

Conclusion

Thailand's Northeast has been left behind the rapid transition to industrialization of the nation's primary urban center. The region trails the rest of the country in education, labor productivity, and job opportunities. When Isaanese engage in rural-to-urban migration to reap the benefits, they are often directly excluded in social, consumer, and residential opportunities either by upper and middle classes or indirectly by Thai policies. This thesis attempts to take a wide approach to increase the rate of welfare convergence in Isaan and for Isaanese labor migrants in Bangkok.

A significant driver of rural-to-urban migration, in Isaan and globally, is climate change. Despite almost 70 percent of households in the Northeast engaged in farming, farm productivity continues to lag behind almost every other region due to increasingly unstable climate conditions and farming practices that exhaust the natural resource endowments. In the face of increasingly intense periods of climate-exacerbated floods and droughts, changes can be made to improve productivity and sustainability of Isaanese agriculture, a pillar of Isaanese economics and identity. These changes mainly involve the utilization of Climate Smart Agriculture and Regenerative Agriculture on different time scales. For the immediate term, Climate Smart Agriculture can be used to improve the well-being of Isaanese farmers in that the primary focus is to increase farm productivity in a climate-resilient fashion. As a part of Climate Smart Agriculture introduction of GMOs, supplementary irrigation, resilient crop varieties, flexible cropping schedules, and

integrated pest management will likely curb one of the primary drivers of Isaanese outmigration. Regenerative Agriculture can be used to improve the long-term health of the agricultural system. Promoting conditions that increase the diversity of microorganisms in the soil has significant potential to address the underlying issue of climate change.

In addition to revamping agricultural practices, the creation and development of secondary cities in Isaan may offer its residents opportunities to achieve agglomeration and experience increasing rates of welfare convergence. These may be particularly relevant in cities with newly established universities, such as the provincial capital Kalasin, or in cities that have established university systems, but lack significant means of connectivity to other urban centers, like Maha Sarahkam City. Implementing effective connections between urban centers in Bangkok and within the Northeast, while maintaining a passive stance with respect to internal migration will likely raise the Northeast out of low economic productivity and poverty.

Thailand's long history of taking an active approach to internal migration has likely deprived its poor labor migrants and the country from the benefits that accompany voluntary internal movement. By either directly implementing policies that dilute the concentrations of ethnic minorities with others hand-chosen by the Thai state, or executing projects that would eventually create barriers for rural migrants to settle in Bangkok, the country has largely failed to benefit from increasing rates of welfare convergence. To raise living standards of those who have not been able to experience the benefits of Thailand's rapid economic growth, Thailand must ensure their existing

policies and development are not actively encouraging or discouraging any specific internal movement, especially in emerging urban centers and secondary cities.

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